

Management Insights

Production, Process Investment and the Survival of Debt Financed Startup Firms

Fehmi Tanrisever, S. Sinan Erzurumlu, Nitin Joglekar

Over 70,000 firms are launched in the US alone every year. A sizable number of these startups require process investments to reduce their production cost. Whether to invest in process R&D to reduce unit cost and raise future profits, instead of conserving cash to reduce the likelihood of bankruptcy is a dilemma faced by many startups firms after launch. Fehmi Tanrisever, Sinan Erzurumlu, and Nitin Joglekar offer insights for managing this dilemma by examining the production quantity and cost-reducing R&D investment decisions in a two-period model. In this setting, the startup must make predetermined amount of profit at the end of this first period in order to survive and play in the second period. The authors show that with deterministic demand, it is optimal to deploy *all-or-nothing* R&D investment policy and to produce monopoly quantity. However, under a probabilistic survival constraint, the authors establish conditions when the startup can create *operational hedges*: make a “conservative” process R&D investment and then increase its survival chances by sacrificing some first period expected profits, i.e. produce less than the monopoly quantity. Alternatively, startups can invest “aggressively” and produce more than the monopoly quantity to cover the higher survival risk associated with aggressive R&D investment.

Complementary Drivers of NPD performance: Cross-functional coordination, information system capability, and intelligence quality

Elliot Bendoly, Anandhi Bharadwaj, Sundar Bharadwaj

Growth is a major challenge for firms. Revenue growth through acquisitions is expensive and integration challenges lead to failure in a significant number of cases. Consequently firms and the investment community value organic growth. Revenues delivered by new products are the key mechanism for organic growth. This study’s findings suggest that managers need to maintain an open mind regarding the knowledge generating potential of routine cross-functional

coordination activities. The value of such activities in generating actionable intelligence that can aid in the pursuit of organic growth from new products can be significant. All too often, firms make the mistake of focusing exclusively on isolated drivers of performance – for example, bridging the process gap by fostering alignment activities (such as joint planning, weekly meetings, etc.) without adequate technological support for effective coordination. Elliot Bendoly, Anandhi Bharadwaj, and Sundar Bharadwaj show that important synergistic benefits will accrue to firms that focus on addressing both process (i.e. cross-functional coordination) and technology gaps in tandem. Managers should take care to appreciate the knowledge generation potential of all operational activities, not just those of R&D departments, and how such potential can be supported and encouraged via information systems investments.

A Production-Inventory Model for a Push-Pull Manufacturing System with Capacity and Service Level Constraints

Feng Cheng, Markus Ettl, Yingdong Lu, David D. Yao

Feng Cheng, Markus Ettl, Yingdong Lu, and David Yao study a hybrid push-pull production system with a two-stage manufacturing process, which builds and stocks tested components for just-in-time configuration of the final product when a specific customer order is received. One important planning issue is to find the right trade-off between capacity utilization and inventory cost reduction that strives to meet the quarter-end peak demand. The authors present both component-based and product-based nonlinear optimization models to minimize the total inventory cost subject to the service level constraints and the production capacity constraints. An efficient algorithm using decomposition is developed for solving the nonlinear optimization problems.

The authors observe that risk pooling effect can be a significant factor for both models. While both models will need to build ahead when capacity is tight, the kit fabrication requirements force the product-based model to build components even earlier, hence lead to higher inventory costs. Also the component-based model is more flexible and cost effect since it can

choose to build less cost components first and more expensive components later. In addition, the authors observe that the demand skew has little effect on the inventory cost when capacity is unconstrained. When capacity is constrained, the inventory cost increases for all products as the degree of demand skew increases. Moreover, the impact of demand skew is greater in the product-based model than in the component-based models (either with risk-pooling or without risk-pooling).

A Universal Appointment Rule in the Presence of No-Shows and Walk-Ins

Tugba Cayirli, Kum Khiong Yang, Ser Aik Quek

The performance of existing appointment-scheduling rules suggests that no single rule performs best in all clinical environments. The best appointment rule must be chosen relative to the clinical environment to achieve a desired trade-off between the patient's waiting times and the doctor's idle time and overtime.

Tugba Cayirli, Kum Khiong Yang, and Ser Aik Quek develop a universal appointment rule for clinics with different levels of no-shows, walk-ins, service time variability, number of patients scheduled per session as well as different value of patients' time to doctor's time. Comparisons with existing appointment rules in the literature show that the proposed universal rule provides a robust approach for finding good schedules for different clinical environments. The authors developed a decision support tool, and it is available as an open source (<http://www.appointmentschedulingtool.com/>) for practitioners responsible for scheduling appointments.

Designing Service Level Contracts for Supply Chain Coordination

Marcel A. Sieke, Ralf W. Seifert, Ulrich W. Thonemann

The relationship between sellers and buyers in a supply chain is governed by supply contracts. In many industries, service level based supply contracts are commonly used. Under such a contract, a company agrees to achieve a certain service level and to pay a penalty if it misses it. Sieke, Seifert and Thonemann analyze how buyers choose optimal order quantities under service level based supply contracts and how these contracts can be parameterized, such that the profit of the supply chain is maximized. The results of their analyses can be used by decision makers to design optimal service level contracts and to provide a tool for contract negotiations.

Managing Supply Chain Execution: Monitoring Timeliness and Correctness via Individualized Trace Data

Jun Shu, Russell Barton

Information technologies provide new opportunities to control and improve the business processes based on data. A class of data, *individualized trace data* (ITD), identifies the real-time status and history of individual entities as they move through execution processes, such as an individual product moving through a supply chain or a uniquely identified mortgage application moving through an approval process. Shu and Barton develop a mathematical framework which they call State-Identity-Time (SIT) Space to represent and manipulate ITD at multiple levels of aggregation for different managerial purposes. Using this framework, they design a pair of generic quality measures – timeliness and correctness – for the progress of entities through a supply chain. It is widely believed that trace data can provide *visibility*. Most of the current attention on visibility is focused on what the authors call “asset visibility” where products, materials, vehicles or customers are located and counted in order to report more accurate inventory. Their timeliness and correctness metrics provide “behavioral visibility” that can help managers to grasp the dynamics of supply chain behavior before problems emerge through the asset visibility. The authors also develop special quality control methods to address the issue of overreaction that is common among managers faced with large volume of fast changing data. Based on the reality reflected through ITD, managers can determine *if*, *when*, and *where* to react in addition to *how* to react.

Design of Extended Warranties in Supply Chains under Additive Demand

Kunpeng Li, Suman Mallik, Dilip Chhajed

Selling extended warranties on products is a highly profitable and rapidly expanding business. Kunpeng Li, Suman Mallik, and Dilip Chhajed investigate two types of extended warranty practices for a manufacturer or a retailer: (1) being a provider of extended warranty; (2) being a reseller of extended warranty provided by a third party. They show that the retailer, with a higher rate of profit improvement, benefits more from being a provider of extended warranty, unless he has substantial repair cost disadvantage than the manufacturer. They also provide guidelines for helping a retailer or a manufacturer make the right choices to be a provider or a reseller of extended warranty. Furthermore, their research implies that the extended warranty is not merely a source of revenue;

it also can be used strategically in channel choices to improve system profits and in making product pricing decisions.

Service and Price Competition When Customers Are Naïve

Li Li, Li Jiang, Liming Liu

In a typical service setting, service is fast relative to customer arrival, and customers are unaware of the service rates at the providers. Customers often adopt simple rules to select service providers upon arrival and jockey between queues while waiting, by use of such observable information as queue length and service fees. This makes them look naïve in behaviors. Li Li, Li Jiang, and Liming Liu analyze the decisions by the service providers on service speeds and prices in a competitive environment when the customers are naïve. Their model results suggest that neither service provider can simultaneously set a lower price and provide a faster service than its competitor. Further, the service providers tend to invest in lower service rates and engage in less intense price competition, while customers have to spend longer time waiting for service, when customers are naïve than when they can make use of service rates to make sophisticated service selections.

Flexible Servers in Understaffed Tandem Lines

Eser Kırkızlar, Sigrún Andradóttir, Hayriye Ayhan

Understaffed production lines with finite buffer spaces and multiple workers are typical in the garment manufacturing industry, assembly plants, and warehouses. In these settings, labor costs constitute a big proportion of the operating costs, and hence it is important to use the workforce effectively. With the objective of maximizing the production rate, Kırkızlar, Andradóttir, and Ayhan identify optimal cross-training strategies, optimal worker assignment policies, and near-optimal worker assignment heuristics for understaffed tandem lines, and confirm that it is possible to attain most of the benefits of full flexibility with partial flexibility. Moreover, this research provides the following managerial insights: (i) an

effective flexibility structure that is robust to service time distributions and buffer sizes can be identified by solving a linear program; (ii) the efficiency loss due to the finite buffer size can be alleviated through the right choice of critical skills; (iii) making all workers partially flexible is usually better than making some of them dedicated and some of them fully flexible; (iv) when there is a dedicated worker, the priority of the flexible worker should be to prevent the starving or blocking of the dedicated worker; (v) the priorities of the workers may depend on the buffer sizes.

Early Sales of Seasonal Products with Weather-Conditional Rebates

Fei Gao, Ozgun Caliskan Demirag, Frank Y. Chen

Weather related uncertainty introduces challenges for many retailers selling seasonal products under weather-sensitive demand: they may generate high sales and profits in “favorable” weather states but may incur severe financial loss in “unfavorable” states. Often times, many decisions must be made prior to observing the weather status, complicating the demand-supply match considerably. To induce pre-season sales and increase profits, some retailers offer weather-conditional rebate programs. The basic premise of such promotions is as follows: If a certain unfavorable weather condition is observed during the regular season, customers who made early purchases in an advance pre-selling period are given rebates as a form of compensation for low satisfaction. Fei Gao, Ozgun Caliskan Demirag, and Frank Chen investigate the potential benefits of weather-conditional rebate promotions in a model that considers the retailer’s inventory decisions in two periods. They show that the retailer can use weather-conditional rebates to price discriminate a customer’s post-purchase states and increase sales. The program can also lead to savings in inventory holding cost due to early sales and in ordering cost; hence it can increase profits. The analysis is applicable to more general conditional-rebate programs such as where the rebate offer is linked with the outcome of an important entertainment or sports event.